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Cod response to past and current warm phases in the Seas of Iceland, a time series analysis

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ABSTRACT

Climate change, and in particular global warming, is already affecting the Arctic and is expected to continue in the near future. A sustainable use the Arctic resources requires an increased understanding of its functioning that helps us anticipate change and adapt to it. Cod time series in Iceland cover a period of more than 50 years. Three distinct phases can be identified over this span of time: (1) the current warm phase characterised by relatively high cod biomasses, (2) an earlier phase (around the 1950s) with similar conditions separated by (3) some 20 years of cold temperatures and low biomasses. The aim of this study is to identify possible regime-dependent dynamics associated to these warm and cold phases that can help us identify key drivers in the current and future warm regime. To do this we compiled a database of fishing pressure, hydrographical and biological (copepods and euphausiids) variables as well as three cod population descriptors: (i) total spawning stock biomass, (ii) the population growth rate derived from matrix population models and (iii) disaggregated number at age time series. These three cod indices were subsequently regressed (GAM and threshold GAM) against the environmental and anthropogenic variables. Our results point out a probable regime-dependent mechanism where plankton effects would only be important for cod under warm conditions. No threshold-like responses were found in the population growth rate nor in the number at age for the various age classes.

Keywords: Arctic cod, regime shifts, trophic control, thresholds

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